Application

for

United States Letters Patent

To all whom it may concern:

Be it known that

PAUL MUDD

has invented certain new and useful improvements in

METHOD AND APPARATUS FOR FABRICATION OF A SELF-SUPPORTING BANDED COIL

of which the following is a full, clear and exact description.

Method and Apparatus For Fabrication Of A Self-Supporting Banded Coil

REFERENCE TO RELATED APPLICATIONS

This application claims the filing date of Provisional Patent Application No. 60/289,351, filed May 8, 2001.

BACKGROUND OF THE INVENTION

1. ***Field of the Invention*** – This invention relates to a method and to a device. More specifically, this invention relates to method for the storage and transportation of a banded coil of flaccid products, and to the apparatus utilized in this method. More specifically, a banded coil of a flaccid product such as wire, hose, fabric, chain link, or rope wire, is formed utilizing a reel of composite construction. In the method of this invention, the flaccid product is wound onto the composite mandrel of a reusable spool or reel, such flaccid product is then banded into a self-supporting coil while on the mandrel and, thereafter, one of the flanges disengaged from the arbor of the spool or reel which supports the mandrel. Such disengagement of the flange allows for reduction in diameter of the mandrel and, thus, removal of the banded coil of flaccid products from the mandrel.

2. ***Description of the Prior Art*** – Typically in the manufacture of a flaccid product (e.g., wire, hose, fabric, chain link, or rope, etc.), such product is continuously formed on some apparatus and wound upon a spool or reel at the fabrication station of the product manufacturing location. Normally, the flaccid product is shipped on the take-up spool used to collect the flaccid product.

This take-up spool is generally bulky, heavy and adds substantial expense to the cost of the product, which is, by necessity, bundled with it. In addition, after the product is unwound, the reel is then returned, recycled or discarded, a process that is both wasteful and expensive. Another disadvantage is the fact that as the product is unwound, the spiraling method of unwinding results in twists in the product and possible damage. In order to avoid such added expense and potential damage incident to such take-up spools, various methods and apparatus have been proposed to eliminate and/or minimize these problems. The following patents are representative of this limited effort.

U.S. Patent No. 5,649,677 (to Barney Culp, issued July 22, 1997) describes a reel on which a coil of flaccid material can be placed and unwound in a manner opposite to how it was wound in the reel and is also collapsible. However, the method described in this patent is both cumbersome and expensive.

US Patent 6,234,421 *(to Cox, et al.* issued May 22, 2001*)* discloses a method for reinforcing a relatively inexpensive spool used to store and transport flexible media. The *Cox, et al.* disclosure is informative as to the steps taken by industry to provide an acceptable, yet inexpensive spool for the storage and dispensing of flexible media. Obviously, the prior efforts to minimize the expense of such spools has only created another set of problems, which the *Cox, et al.* patent reportedly resolves. Notwithstanding, the efforts by *Cox, et al.* and others, the use of spools to collect, store, transport and dispense flaccid products has continued, even though the added cost thereof, and additional shipping expenses attributable to their use, is substantial.

Notwithstanding, the efforts by *Cox , et al. and* others, there has been little, if any, effort made to provide alternative means to collect, store, transport and dispense flaccid product. Accordingly, there continues to exist a need to provide an alternative to the present methods for

handling flaccid products such as wire, hose, fabric, chain link, or rope, which is both compatible with present methods of manufacture and yet eliminates the current disadvantages inherent with the prior art use of spools and reels.

Objects of the Invention

It is an object of this invention to remedy the above and related deficiencies in the prior art. More specifically, it is the principle object of this invention to provide a method and apparatus for the handling of a coil flaccid product in a more efficient and cost effective manner.

It is another object of this invention to provide a method and apparatus for the handling of a coil of flaccid product in which the coils can be easily removed from and replaced onto a reel.

It is yet another object of this invention to provide a composite spool/reel that permits product wound onto the spool/reel to be banded and easily removed as an intact coil.

Additional objects of this invention include the an article of manufacture in the form of a banded coil of flaccid product, which can be removed from a spool or reel without unwinding.

Summary of the Invention

The above and related objects are achieved by providing a method wherein a flaccid product is taken up onto a mandrel of a take-up spool. The mandrel of the take-up spool comprises at least two complimentary components, including an expandable mandrel and a tapered ring, each of which is attached to their respective flanges of spool at the hub of each flange. The expandable mandrel component of the composite mandrel consists essentially of a plurality of curvilinear sections arranged about a central axis so as to form a cylinder which can permanently affixed to one flange

of the spool; and, a tapered ring that is releasably affixed to the other flange of said take-up spool. The relative diameter of each of the expandable mandrel and the tapered ring permit insertion of the ring into the open end of the expandable mandrel, and thereby assembly and locking each of the components thereof into a unitary spool structure. The assembly of the components of the spool causes the tapered ring to exert radial forces upon the interior of the expandable mandrel, and thereby radial displacement of the curvilinear surface thereof so as to cause an increase in its cross-sectional diameter of the expandable mandrel.

The flaccid product is now releasably affixed (anchored) to the mandrel and the flaccid product wound into a coil onto the mandrel in the conventional manner. Slots in each of the flanges of the spool permit the insertion of banding materials around the coil of the product subsequent to its take-up onto the composite mandrel of the take-up spool, and, while the product remains on the mandrel. Once the coil of flaccid product has been securely banded, the retainer means on the flange of the tapered ring is removed. The removal of the retainer means allows for both the removal of the flange associated with the retainer ring, and the release of tension on the tapered ring. With the relaxation of tension on the tapered ring, the axial pressures exerted by the tapered ring upon the expandable mandrel are also released so as to decrease the cross-sectional diameter of the mandrel relative to the banded coil of flaccid product that is supported thereon. At this juncture, the coil of banded product can be slid off of the mandrel. The spool can be reassembled by simply reversing this process.

Brief Description of the Drawings

Fig. 1 depicts an exploded view of the take-up spool of this invention.

Fig. 2 depicts an end on view of the removable flange of the take-up spool of Fig. 1.

Fig. 3 depicts an end on view of the flange of the take-up spool of Fig. 1 that is fixedly attached to the composite mandrel.

Detailed Description of the Invention
Including Preferred Embodiments

The take-up spool suitable for use in the method of this invention is depicted in the figures that accompany this application. Where an element is the same in more than one of these figures, it is assigned a common reference numeral for ease of understanding and continuity of expression.

Fig. 1 provides an exploded view of a take-up spool (10) suitable for use in the method of this invention. In Fig. 1, each of a retaining means (12) and removable flange (20) have been physically displaced relative to a center tube or arbor (16) of a tapered ring (18), which forms the core of the take-up spool (10). As depicted therein, this retaining means (12) comprises a threaded fastener that can be screwed onto the complimentary thread of the center tube (16) of the tapered ring (18). Once this retaining means (12) has been disengaged from this center tube (16), the removable flange (18) can also be disengaged from the center tube or arbor (16) by axial movement thereof, thereby exposing the composite mandrel (22) of the spool (10). The axial movement of this flange (20) also disengages it from a series of interlocking pins (24) associated with a tapered ring (18) of the take-up spool. These interlocking pins (24) are intended to engage and lock the removable flange (20) in the fixed position relative to the mandrel (22), and thereby allow for transfer of torque to the composite mandrel (22) upon rotation of the removable flange (20).

As noted above, this composite mandrel (22) consists essentially of multiple, curvilinear sections (24, 26 & 28), that are circumferentially arranged in an array around the axis of rotation of the take-up spool. The mechanical integrity of this composite mandrel (22) is maintained by each of the flanges (20, 20') which are positioned on either end thereof. Moreover, each of these flanges (20, 20') of the take-up spool provide traversing stops during operation of the take-up spool, specifically, a means for maintaining the windings of the flaccid product in a uniformly constant wound bundle, on the composite mandrel (22) of the take-up spool (10).

The composite mandrel (22) of Fig. 1 also preferably includes a tapered ring (18) which fits within the chamber (32) defined by the curvilinear sections (24, 26 & 28) of the composite mandrel (22). This tapered ring (18) is maintained within the open end (30) of the composite mandrel (22) by means pressure contact between the exterior surface thereof against the interior of the mandrel. In operation, this tapered ring (18), is positioned within the open end (30) of the mandrel (22), and is mechanically expanded by the combined action of a plurality of springs (34) and a collapsible internal cone (36). More specifically, in the assembly on the spool (10), the tapered ring (18) is initially inserted into the open end (30) of the composite mandrel (22), and the removable flange (20) thereafter installed upon the center tube or arbor (16) of the mandrel (22). When the retaining means (12) is now threaded onto the center tube (16) and tightened, a collapsible cone (36) contained within the tapered ring (18) is reduced in height. More specifically, as the retaining means (12) is tightened, a collapsible internal cone (32), within the tapered ring (18), is compressed in one dimension and thereby expands in the cross-sectional diameter of its base so as to cause the tapered ring (18) to exert radial pressure upon the composite mandrel (22). This expansion of the tapered ring (18) within the mandrel (22) results in frictional engagement of the tapered ring (18) with the inside

surface of the flexible mandrel (22). This expansive movement of the tapered ring (18) within the mandrel also results in radial displacement of the curvilinear components (24, 26 & 28) of the composite mandrel (22) and thereby an increase in the cross-sectional diameter of the mandrel. Upon reversal of this process, specifically, the removal of the retainer means (12) and the removal flange (20), the expansive movement tapered ring (18) is reversed, so as to allow the collapsible internal cone (36) to return to its uncompressed position. This relaxation of the radial pressure of the tapered ring (18) upon the composite mandrel (22), cause a corresponding reduction in the cross-sectional diameter of the mandrel (22).

The dynamics of operation of the take-up spool (10) of this invention are uniquely compatible with the banding of flaccid product that can be wound about the composite mandrel of the take-up spool. That is to say, upon completion of the winding of the flaccid products, to the degree or limits permitted by the physical constraints of the spool, banding straps/cables (not shown) are inserted through the slots (38, 38') in each flange (20, 20'), wrapped and tied about the wound bundle so as to form a self-supporting coil of flaccid product. In order to facilitate this banding, the composite mandrel (22) is also provided with a series of grooves (40, 40') corresponding to slots (34, 34') in each of the flanges (20, 20') of the spool (10). These grooves (40, 40') in the mandrel, which run along the mandrel from one flange (20, 20') to the other, guide the banding materials under the wound bundle of flaccid product, and thereby allow the banding to secure the bundle into a self-supporting coil prior to its removal from the mandrel. Thus, when the bundle of flaccid product has been secured within the banding, the retaining means (12) can be removed from the threaded end of the tube or arbor (16), and the removable flange (20) disengaged from the composite mandrel (22). As above noted, the combined action of removal of the retaining means (12) and disengagement of

the removable flange (20) from the composite mandrel (22) permits relaxation of the radial forces that are exerted by the tapered ring (18) against the interior surface of the composite mandrel (22). This relaxation of the radial forces also causes a reduction in diameter of the composite mandrel, so as to permit release of the banded coil from the curvilinear surface (24, 26 & 28) of the mandrel (22). The banded coil of flaccid product can now be easily removed from the mandrel of the take-up spool, and the spool, thereafter reassembled and reused repeatedly. The banding of the flaccid products in the foregoing manner not only simplifies the shipment thereof, but also substantially reduces the cost of the coil, by reducing shipping costs.